# Discussion Paper: Draft Range of Options for Agricultural Water Measurement

[*Note: This paper represents an initial draft proposal on agricultural water measurement. It is provided to assist the ASC in its initial discussions. The draft should be viewed as a work in progress, based upon preliminary understanding of provisions in the Water Conservation Act of 2009, referred to below as SBx7-7. It should not be viewed as DWR's official position. DWR invites comment and input on the draft and identified questions as presented in this paper. DWR also will form an ASC subcommittee focused on the topic of options for water measurement that will provide additional input. Comments should be submitted to DWR staff at agwue@water.ca.gov.*]

SBx7-7, enacted in November of 2009, includes provisions on water conservation, measurement, and reporting activities for agricultural water suppliers. DWR is coordinating with the Agricultural Water Management Council and a stakeholder committee in advance of developing a regulation for a range of agricultural water measurement options that water suppliers may use to measure water delivered to customers.

## 1.0 Provisions Related to Agricultural Water Measurement

Paragraph 10608.48(i)(1) of SBx7-7 states:

> *The department shall adopt regulations that provide for a range of options that agricultural water suppliers may use or implement to comply with the measurement requirement in paragraph (1) of subdivision (b).*

That paragraph refers to 10608.48(b) of SBx7-7:

> *Agricultural water suppliers shall implement all of the following critical efficient management practices:*
>
> *(1) Measure the volume of water delivered to customers with sufficient accuracy to comply with subdivision (a) of Section 531.10 and to implement paragraph (2).*
>
> *(2) Adopt a pricing structure for water customers based at least in part on quantity delivered.*

Section 10813 defines customer as "*a purchaser of water from a water supplier who uses water for agricultural purposes.*"

Section 531.10 of the California Water Code requires that:

> *(a) An agricultural water supplier shall submit an annual report to the department that summarizes aggregated farm-gate delivery data, on a monthly or bi-monthly basis, using best professional practices.*

> *(b) Nothing in this article shall be construed to require the implementation of water measurement programs or practices that are not locally cost effective.*

Note also that Section 531 defines a lower size threshold for aggregate reporting purposes than SBx7-7 specifies for its measurement regulations.

Paragraph 10608.12 (a) of SBx7-7 states:

> *"Agricultural water supplier" means a water supplier, either publicly or privately owned, providing water to 10,000 or more irrigated acres, excluding recycled water. "Agricultural water supplier" includes a supplier or contractor for water, regardless of the basis of right, that distributes or sells water for ultimate resale to customers. "Agricultural water supplier" does not include the department.*

Further, agricultural water suppliers that provide water to less than 25,000 acres only need to comply if funding is provided to cover additional costs imposed (see section 10853).

In contrast, Section 531 of the Water Code states:

> *531(b) "Agricultural water supplier" means a supplier either publicly or privately owned, supplying 2,000 acre-feet or more of surface water annually for agricultural purposes or serving 2,000 or more acres of agricultural land. An agricultural water supplier includes supplier or contractor for water, regardless of the basis of right, which distributes or sells water for ultimate resale to customers.*

## 2.0 Timeline for Agricultural Water Suppliers to Comply with Measurement Requirements

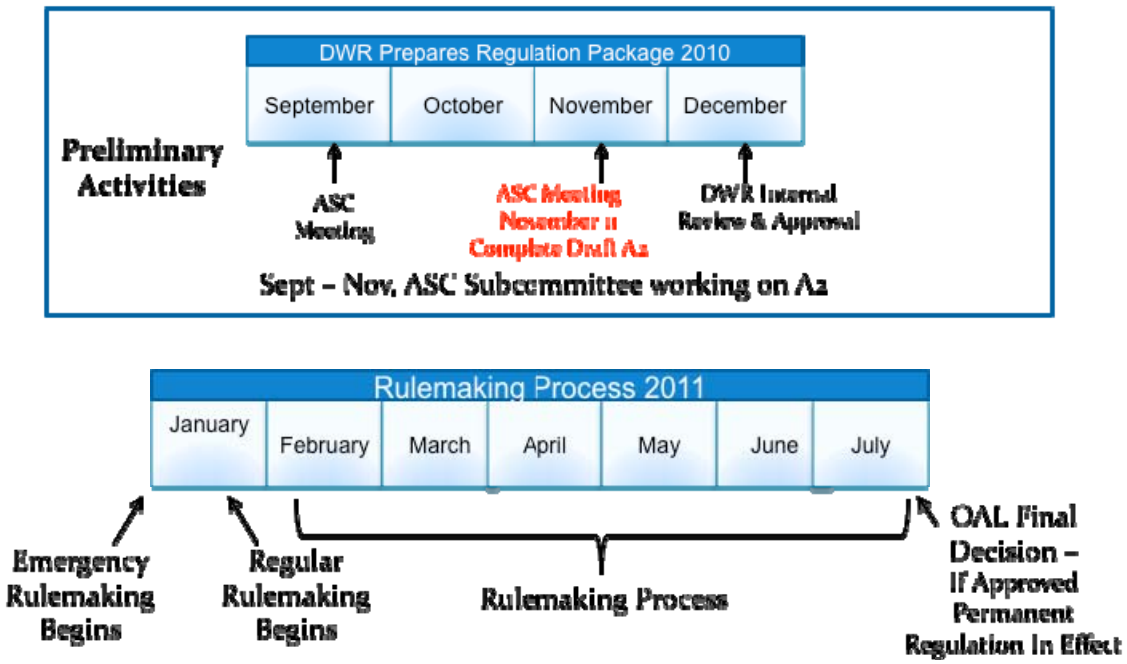
DWR is authorized to issue an emergency regulation to provide for a range of measurement options. The emergency regulation will be followed by a permanent regulation. DWR intends to issue the emergency regulation by January, 2011 and the permanent regulation by July 2011 to allow time for agricultural water suppliers to plan and implement the water measurement and water pricing requirements of SBX7-7. Several sections of SBx7-7 determine the date by which agricultural water suppliers must comply with the measurement requirements. These are:

- Paragraph 10608.48(a) of SBx7-7 sets July 31, 2012 as the date by which agricultural water suppliers shall implement efficient water management practices that include measuring the volume of water delivered to customers.
- Notwithstanding the July 31, 2012 date stated in paragraph 10608.48(a), SBx7-7 paragraph 10608.56 (b) establishes the onset of the grant and loan eligibility test to be July 1, 2013:

> *On and after July 1, 2013, an agricultural water supplier is not eligible for a water grant or loan awarded or administered by the state unless the supplier complies with this part.*

- Agricultural water suppliers will still be eligible for grants and loans if the supplier has submitted to DWR for approval a schedule, financing plan, and budget, to be included in the grant or loan agreement, for implementation of the efficient water management practices (paragraph 10608.56 (d)).

Based on the dates that apply to agricultural water suppliers above, DWR staff has defined a timeline to develop and adopt its emergency and permanent regulations. DWR anticipates submitting its text of the emergency regulation to the Office of Administrative Law (OAL) in early January of 2011. Additional steps and dates are reflected in Figure 1.




# 3.0 Applicability

Only agricultural water suppliers that provide water to more than 10,000 irrigated acres are subject to the water measurement regulations (section 10608 (a)). Further, agricultural water suppliers that provide water to more than 10,000 irrigated acres but less than 25,000 acres only must comply with water measurement requirements if sufficient funding is provided specifically for that purpose (section 10853).

Both of these acreage thresholds exclude acreage served by recycled water. Recycled water means municipal or industrial wastewater that has been treated for waste and is thus usable for irrigation (section 13050 (n) of the California Water Code). It does not mean untreated return flow from other irrigated lands.

It is important to distinguish between the acreage thresholds for reporting purposes under Section 531, and the acreage thresholds for the measurement requirements. All agricultural water suppliers "supplying 2,000 acre-feet or more of surface water annually for agricultural purposes or serving 2,000 or more acres of agricultural land" must meet the reporting requirements of Section 531.10(a). The following summarizes how the Section 10608 (a) water

measurement requirements will apply to agricultural water suppliers depending on the size of the agricultural water supplier's irrigated area.

- **Agricultural water suppliers that serve less than 10,000 irrigated acres** are not subject to the water measurement requirements. They remain subject to measurement requirements of Section 531 of the Water Code if they deliver more than 2000 acre feet of water or irrigate 2000 or more acres of land.
- **Agricultural water suppliers serving 10,000 or more irrigated acres but less than 25, 000 irrigated acres** are not required to implement the water measurement requirements unless sufficient funding is provided specifically for that purpose.
- **Agricultural water suppliers serving 25,000 irrigated acres or more** shall measure water deliveries consistent with the water measurement requirements.

Any agricultural water supplier that meets the water measurement requirements developed under paragraph 10608.48(i)(1) of SBx7-7, and submits an annual report to the Department that summarizes aggregated farm-gate delivery data on a monthly or bi-monthly basis, will also be deemed to comply with the reporting and measurement requirements of section 531.10 of the Water Code.

Agricultural water suppliers include both retail and wholesale water suppliers. Wholesale water suppliers include entities responsible for conveyance and delivery of agricultural water, provided that they meet the size thresholds described above. This latter category includes but is not limited to, authorities that operate canals or other water conveyance and delivery facilities. DWR is specifically excluded from the definition of an agricultural water supplier. Federal agencies, such as the U.S. Bureau of Reclamation, are also excluded.

Over what period of time should a water supplier's irrigated acreage be calculated? For example, averaged over 3 years, or 5 years?

What lands should and should not be included in irrigated acreage? Discussion: lands within state or federal refuges are generally not included. Should private lands receiving water to irrigate forage for wildlife be included?

## 3.1 Applicability to Wholesale Suppliers

A wholesale supplier or other, non-retail entity subject to the water measurement requirements must measure deliveries to its customers only. It is not required to measure deliveries that its retail customers make to their customers. For example, if a wholesale supplier delivers water only to ten retail agricultural water suppliers, and those retail suppliers serve a total of more than 25,000 irrigated acres, the wholesale supplier must measure deliveries to each of the ten retail suppliers, but not to the individual customers served by each of the ten retail suppliers. If the wholesale supplier also delivers water to final agricultural customers, it must also measure deliveries to each of those customers.

To determine whether it meets acreage thresholds for compliance, the wholesale water supplier or other entity must include all customers' irrigated acres that fall within the service boundary of the wholesale supplier.

# 4.0 Requirements and Criteria

The following requirements and criteria apply to the agricultural water suppliers.

- Suppliers must measure water delivered to customers. The measurement must be accurate enough to allow the water supplier to charge its customers at least in part based on volume of water delivered (section 10608.48(b)(1));

- Measurement in 10608.48(i)(1) refers only to water delivered to customers by an agricultural water supplier. It does not include groundwater pumped from private wells even though the groundwater may be managed by a public agency. Groundwater pumped by wells owned by the agricultural water supplier and provided to customers as part of its delivered irrigation water is subject to the requirements. Irrigation return flow leaving fields, farms, or water supplier boundaries is not subject to the measurement requirements, except if it is collected by the water supplier and provided as irrigation delivery to other customers.

- Measurement in 10608.48(i)(1) refers only to water delivered under the control of the water supplier. For example, water delivered by the retail supplier to a customer at a turnout is subject to the measurement requirements; however, the customer may route that delivery to one or more fields on his or her farm, and delivery to each of those fields would not be subject to the measurement requirements. Similarly, a wholesale supplier must measure the delivery to its customers.. The wholesale supplier is not responsible for measuring water delivered to each of the retail supplier's customers.

- A customer is defined in section 10813 as a "purchaser of water from a water supplier who uses water for agricultural purposes."

- In most cases a water supplier's customers would correspond to its billing accounts. Nevertheless, measurement must occur at discrete physical locations, so if a supplier delivers water to one customer at more than one location, the measurement requirements apply at each of those delivery locations.

Should customers include only those who pay the supplier for water? Discussion: some users may receive delivery at no cost, for example if they held a pre-existing water right.

How should "agricultural purposes" be defined? Discussion: irrigation water for crop production is included. Other possibilities: dairies, feedlots, and other livestock facilities; water used to irrigate forage for wildlife on private lands, such as for hunting clubs.

# 5.0 Water Measurement Range of Options

DWR is required by 10608.48(i)(1) to develop and adopt a regulation that provides for a range of measurement options. These options allow for a range of conditions and delivery system configurations, including pressurized pipe delivery, non-pressurized pipe delivery, and open-channel delivery.

There are two primary approaches for water measurement requirements:

(1) Create a list of acceptable measurement devices maintained in defined manners to achieve desired accuracy, or

(2) Specify measurement accuracy standards that could be met by a range of devices. Included under this option would be requirements defining standards for device rating or calibration and setting minimum standards for frequency of measurement and quality control.

DWR staff proposes that the requirements be based on the second approach – defining a measurement accuracy standard(s).

The use of accuracy standards rather than specifying measurement devices is believed to meet the intent of the legislation in the most flexible and cost-effective manner, because:

- Dictating specific devices can unintentionally constrain suppliers or impose unreasonable or unnecessary costs to accommodate the defined devices.
- Measurement requirements are to assure agricultural water suppliers are able to meet 10608.48(b), which states "Measure the volume of water delivered to customers with sufficient accuracy…" The paragraph is stated in terms of measurement accuracy, not specific devices or technologies.

Attachment 2 provides examples of accuracy standards developed by USBR and other western states. It is worth noting that, of the six states (Arizona, Colorado, Idaho, Kansas, Oregon, and Washington) surveyed for the CALFED report only one, Arizona, had numerical accuracy standards for points of irrigation water delivery by suppliers to individual customers. None of those surveyed required specific hardware devices (though some included examples of devices that would comply).

Are there other approaches that DWR should consider to provide for a range of water measurement options besides the two listed above?

## 4.1 Water Measurement Options

The water measurement requirements encompass establishing several elements including: (1) accuracy standards, (2) allowable exceptions, (3) device accuracy rating criteria, and (4) data management, and quality control.

### 4.1.1 Accuracy Standards

All measurement devices used by agricultural water suppliers shall meet minimum standards for accuracy of measured delivery. Accuracy is defined as the range of measured delivered volume relative to the actual delivered volume, expressed as a percent calculated as:

100 x (measured volume - actual volume) / actual volume

Suppliers shall use devices that comply with the standard and are installed and maintained using best professional practices such that each device meets the accuracy standard under most normal operating conditions.

The accuracy standard applies to normal operating conditions during the irrigation season.

The accuracy standard would be stated as follows:

> "Agricultural water suppliers, as defined by 10608.12(a), must measure flows during the irrigation season with devices that are operated and maintained to a reasonable degree of accuracy, under most conditions, to +/- ___ percent by volume."

Does the definition provide enough detail? Discussion: This definition is similar to USBR's, and also to other western states' level of detail. "Accuracy", "irrigation season", "under most conditions" need to be defined (also see below).

Is the formula for calculating accuracy the best one to use? Discussion: Accuracy could be defined as +/- volume rather than percent. Other definitions are also possible, but probably best to stay consistent with accepted definitions used by manufacturers and test labs.

How should the "irrigation season" be defined for an agricultural water supplier? Discussion: Many water suppliers also deliver significantly reduced quantities during "off-season" months for such purposes as pre-irrigation, rice decomposition, or other uses. Irrigation flows during these or other periods may be substantially less than flows during normal irrigation events, and may be too small for otherwise compliant devices (that meet the accuracy standard) to meet the accuracy standard.

Should open channel delivery systems have a different accuracy standard than pressurized piped delivery systems? Discussion: A different set of possible devices may apply, but USBR and other western states have set one accuracy standard for all. If requirements are designed solely to meet the two objectives of volumetric pricing and aggregate reporting, is there a reason to have different standards?

## 4.2 Potentially Allowable Exceptions

Because of the diversity in existing water supplier delivery systems throughout the state, exceptions to the defined accuracy standard may be needed in some cases. Exceptions may also be reasonable for suppliers with federal contracts, where standards may already exist. DWR staff poses the following questions for discussion:

Should DWR define a measurement requirement different than what CVP requires of its water service contractors? Discussion: The U.S. Bureau of Reclamation's Mid-Pacific Region has developed measurement standards as part of the criteria for Water Management Plans (2008 Conservation and Efficiency Criteria, Reclamation, 2008). The criteria state that Reclamation's CVP contractors must "measure flows with devices that are operated and maintained to a reasonable degree of accuracy, under most conditions, to +/- 6 percent by volume." The criteria apply to any CVP contractor that is required to submit a Water Management Plan (WMP) in order to satisfy the terms of its contract. Per section 10608.48(f), WMPs approved by USBR are by default accepted under SBX7-7; the same automatic compliance could also apply to the measurement requirement.

What other specific exceptions might DWR need to consider in the regulation? Discussion: The regulation could simply set up a process for exceptions or it could provide rules on when an exception might be allowed.

## 4.3 Device Accuracy Ratings Criteria

To comply with the regulations, agricultural water suppliers must determine the accuracy ratings of each device used to measure water deliveries to customers. The following identifies the acceptable methods and frequency associated with determining a device's accuracy rating.

### 4.3.1 Initial Device Rating

Devices that are less than 5 years old, properly installed, and calibrated, may rely on the manufacturer's accuracy rating. For the manufacturer's rating to be valid, however, the manufacturer must follow best industry practices, including but not limited to, allowing device calibration at third-party testing facilities. Accuracy is typically defined as the range, expressed as a percent, within which all or a large proportion, such as 95%, of delivered flow or volume measurements fall relative to the actual flow or volume. For example, if testing indicates that a calibrated measuring device produces 95% of its measurements within +/- A% of the actual volume, its accuracy would be stated as +/- A%.

Is 5 years an appropriate interval of time to rely on the manufacturer's rating?

How should manufacturer's accuracy rating methods be judged for purposes of meeting the requirements? Discussion: Manufacturers' ratings need to be held to some industry standard so that ratings are deemed to be credible. Can a third-party such as a university or other independent testing lab verify a manufacturer's methods? [Note: the DWR water transfer programs had a process and form for accepting the calibrated metering of groundwater wells involved in groundwater substitution transfers. Should this be reviewed and potentially adopted?]

For field-built devices, initial rating must be determined by field testing.

### 4.3.2 Recalibration Criteria

Each measurement device used by an agricultural water supplier to measure water deliveries to customers must be recalibrated every five years or less to assure continued accuracy of measurement readings. Devices not recalibrated within five years will be considered to have an "expired" accuracy rating and no longer compliant with the criteria. This period of time is established to reflect the typical life cycle associated with the initial manufacturer's rating or a previous recalibration. It also establishes a routine and timely practice for recalibration that correlates with an agricultural water supplier's need to prepare and submit an Agricultural Water Management Plan every five years.

Is 5 years an appropriate interval of time for recalibration?

How should methods be established to assure use of best practices by those performing the recalibration? Discussion: Devices will need periodic recalibration to help suppliers demonstrate the delivery, both for customer billing and to indicate compliance with measurement requirements. For suppliers with many hundreds of devices, recalibration will be a significant and costly effort. Some suppliers may be able to perform the recalibration more efficiently with internal staff. In some cases, specialized equipment and expertise may be needed to test equipment and modify equations, factors, etc.

## 4.4 Example Measurement Devices

DWR could develop an example list of devices that should meet the accuracy standard. The list would need to be updated periodically. All devices, whether listed or not, must be operated, maintained, and calibrated to meet the accuracy standard described above. Therefore, simply installing a listed device would not be sufficient to meet the measurement requirements.

Should an example list be developed by DWR? Discussion: DWR's list would not be part of the regulation, but rather be available for suppliers who are investigating options. The State of Arizona initially included both an accuracy standard and a list of devices in its measurement requirements, but has since abandoned the list of devices.

## 4.5 Data Management, Quality Control, and Reporting

Water suppliers will provide a summary of the accuracy ratings for installed measurement devices as part of their Agricultural Water Management Plans (see Section 10826 (a)). These Plans are submitted every five years by an agricultural water supplier (see California Water Code Section 10800). Reporting will include the following information, summarized by major categories of measurement device:

- Category of Device
- Dates, methods, and entities used for the testing and recalibration
- Number of measurement devices that meet or exceed the accuracy standard.
- Number of devices that do not meet the standard after testing and calibration. The supplier must provide a plan and schedule for recalibration, repair, or replacement of devices not meeting the standard.

How would DWR require reporting of measurement accuracy? Discussion: SBX7-7 requires agricultural water suppliers to measure volume of water with sufficient accuracy to comply with section 531.10 and for pricing structure. Is reporting in Water Management Plans every 5 years an appropriate means for providing evidence of compliance?

[Note: Data management and quality control to be developed]

# Attachment 1 – Glossary (Partial Draft)

The following definitions are used for water measurement options. They define words and phrases that DWR uses in developing and describing measurement options and requirements. Words and phrases that are already defined within the legislation are noted as such.

**This list is a work in progress. Existing definitions may be revised and new definitions will be added.**

Accuracy – For purposes of the requirements, measurement accuracy is defined as the range, expressed as a percent, within which all or a large proportion (say 95%) of delivered volume measurements are expected to fall relative to the actual volume. For example, if testing indicates that a calibrated measuring device produces 95% of its measurements within +/- X% of the actual volume, its accuracy would be stated as +/- X%. The percent shall be calculated as: 100 x (actual volume - measured volume) / measured volume.

Accuracy standard – The specific measurement requirement stated in the adopted regulation, including the numerical value of measurement accuracy.

Aggregate farm-gate delivery –

Agricultural purposes –

Agricultural water supplier – This is defined in the legislation as: "a water supplier, either publicly or privately owned, providing water to 10,000 or more irrigated acres, excluding recycled water. "Agricultural water supplier" includes a supplier or contractor for water, regardless of the basis of right, that distributes or sells water for ultimate resale to customers. "Agricultural water supplier" does not include the department."

Best professional practices –

Calibration – This is a procedure to improve the accuracy of a measurement device. It can include physical adjustments to the device itself or revising the numerical factors used in equations that calculate volume based on flow rate, head, depth, and duration.

Customer – This is defined in the legislation as: "a purchaser of water from a water supplier who uses water for agricultural purposes."

Delivery – The volume of water that the water supplier provides to the customer for agricultural use during a specified period of time. The point of delivery is the physical location at which control of the water is transferred from the supplier to the customer.

Device rating – Measurement devices may be rated for accuracy. Rating may b e done by the manufacturer, by an independent testing laboratory, or by the field personnel after installation. If the manufacturer uses an independent testing laboratory, the measurement and reporting of the rating will be standardized and comparable across devices. Accuracy of a device typically depends on operating conditions, so the rating

may be expressed as a schedule or equation related to flow rate, head difference, or other important factor affecting the device's accuracy.

Irrigated acres –

Irrigation return flow –

Irrigation season –

Measurement device – The physical means by which the water supplier measures the water delivered to a customer. Measurement devices generally fall into two categories: totalizing and non-totalizing. Totalizing devices provide a direct measurement of volume delivered, and include most meters, such as propeller meters. Non-totalizing devices require a combination of measurements, such as flow rate and duration or head difference and duration, in order to calculate volume delivered.

Meter – A measurement device installed specifically to measure the flow rate or volume of water passing a point. A meter typically provides its own mechanical or digital readout, such as instantaneous flow or volume totaled over some period of time. Meters may be installed permanently in a pipe or at a turnout, or they can be portable.

Recycled water - Municipal or industrial wastewater that has been treated for waste and is thus usable for irrigation (see Section 13050 (n) of the California Water Code). It does not mean untreated return flow from other irrigated lands.

Retail water supplier – Any agricultural water supplier that sells water directly to customers for irrigation or other agricultural use.

Volumetric pricing – A revenue mechanism by which a water supplier recovers at least part of its total operations cost by charging customers based on volume of water actually delivered. The volumetric charge must be based on measured volume of delivery, and not on a proxy such as acreage or crop type.

Wholesale water supplier – Any agricultural water supplier that sells water to at least one other agricultural water supplier (*need additional qualifier to exempt water transfers from one retail supplier to another*). A wholesale water supplier may also act as a retail supplier to some of its customers. Canal operating authorities and other entities that convey or distribute water to other agricultural water suppliers are considered wholesale water suppliers.

# Attachment 2 – Examples of Measurement Standards

**USBR's Mid-Pacific Region** has developed accuracy standards for measurement of water delivered by agricultural water suppliers to customers. Its 2008 Conservation and Efficiency Criteria (USBR, 2008) state that agricultural contractors must implement (or show a plan for implementing) certain BMPs, including one for measurement of water delivered to each customer.

- *Agricultural contractors must "measure flows with devices that are operated and maintained to a reasonable degree of accuracy, under most conditions, to +/- 6 percent by volume."*
- *The Water Conservation Criteria provide categories of measurement devices and provide examples of devices in each category. USBR does not specify particular devices that must be used or that it presumes will satisfy the accuracy standard.*

**Other States.** The following information is from Appendix C of the Final Report of the Independent Panel on Appropriate Measurement of Agricultural Water Use (CALFED, 2003).

**The State of Arizona** requires that water suppliers or other responsible parties that are subject to its measurement regulations must measure irrigation water delivered. Approved measuring devices must be installed as close as possible to the wellhead or point of delivery which the device is intended to measure.

- *Entities required to measure must use a device that meets an accuracy standard of +/-10%.*
- *At one time, Arizona maintained a list of approved devices that met the standard, but changes in technology, requests for additions to or deletions from the list, and other factors led it to abandon an "approved" list as too burdensome.*

**The State of Oregon** may require measurement of delivery as a condition of some water rights permits. There appears to be no universal accuracy standard for such permit restrictions. However, governmental entities are required to measure and report diversions of water.

- *Governmental entities in Oregon must measure to an accuracy of +/- 15%. No specific measurement devices are required or pre-approved.*

**The State of Washington** has adopted a regulation (Washington Administrative Code Chapter 173-173) for measuring diversions from surface water and groundwater. The measurement requirement "is not intended to apply to customers of a municipality or public water supply system or members of an irrigation district or similar secondary users."

- *The combined measuring device and data recording system must measure to an accuracy of +/- 10%.*
- *Washington's regulation allows for a range of devices, and identifies the USBR Water Measurement Manual (2001) and manufacturers' ratings as reference information for determining accuracy of measurement devices.*